GEOGRAPHIC PATTERN OF FLUID MILK PRICES: a computer analysis

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PREFACE

The markets for fluid milk have remained essentially local longer than those for most other agricultural commodities. Distinctive forms of classified price plans and of Class I price structures have been maintained in such markets.

In many cases, differences in Class I milk prices exceed the cost of transporting milk from one market to another. Since there is a considerable volume of intermarket sales, price advantages accrue to those dealers in the lower priced markets. The problem becomes more serious as the volume of intermarket sales increases. This, in turn, heightens interest in the use of spatial equilibrium models for aligning Class I prices in the various markets.

The research model reported herein applies reactive programming techniques to data for the Federal order markets. It shows what the geographic pattern of Class I prices in the orders would be if milk flowed between markets wherever Class I prices differed by more than hauling costs. Like any such model, this one involves assumptions about hauling costs, marketing responses, and perfect knowledge.

The most basic assumption is that most local market distinctions have vanished. In fact, milk is processed from and distributed over much wider territories than it was before World War II. Thus, local market price influences have lessened, but are by no means gone. The model is, therefore, a research tool which may serve to indicate some of the major differences between actual prices and prices based on a free-flow pattern.

Particular acknowledgement is due the late Prof. Thomas E. Tramel, Mississippi State University. He developed the rather extensive modifications which proved necessary to convert his reactive programming routine to the new computer equipment currently used by the U.S. Department of Agriculture.

Since the model was applied to Federal milk marketing order data, an organizational clarification seems appropriate. The model was conceived and executed in the Economic Research Service. Federal orders are administered by a separate staff in the Consumer and Marketing Service. They cooperated, but share no responsibility for the findings.

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SUMMARY

In many Federal order milk markets, Class I prices paid to producers for milk used for fluid consumption in 1965 and 1966 differed from those in other order markets by more than the cost of transportation. These Class I price differences reflect the historically local separateness of milk markets. However, as these local distinctions break down due to the longer distances over which milk is distributed, increasing attention must be paid to the geographic alignment of Class I prices.

The principal price changes indicated by the spatial equilibruim model used in this study were price increases in the upper midwest region in which comparatively low prices have prevailed and from which shipments to other markets were indicated. In the Southern Michigan (Detroit) market, the 1965 prices would have been raised 42 cents per hundredweight (nearly 1 cent per quart) and in Chicago by 26 cents (1/2 cent per quart). The high-priced markets to which sizable inshipments were directed by the model included the eastern markets from Boston to Miami, six markets in the south central region, and four markets in western Iowa, South Dakota, and Nebraska. The greatest reduction in prices indicated by the model was for the Delaware Valley (Philadelphia) market and would have amounted to 45 cents per hundredweight (nearly 1 cent per quart). However, most of the indicated price reductions would have been smaller; they would have exceeded 23 cents per hundredweight (1/2 cent per quart) in only five markets.

The extent of geographic misalignment of prices depends on the transportation cost and other assumptions built into the model. The spatial equilibrium models commonly used to analyze the geographic alignment of Class I prices determine what prices would have prevailed if milk moved freely among markets until Class I prices differed by no more than transportation costs.

Features of the model presented herein include (1) the free flow of milk, bulk or packaged, at Class I prices, (2) a transfer cost of 1.5 cents per hundredweight per 10 miles, measured between market centers, (3) a supply-demand adjuster in each market to raise prices in the low-priced markets from which shipments are indicated and to reduce prices in the high-priced markets as local supplies are displaced by milk from lower priced markets, and (4) demand functions to adjust local consumption to the price changes resulting from the shipments indicated by the model.

The geographically aligned prices resulting from the model could be further modified to accommodate other factors which are important in the structure of Class I prices. The general level of Class I prices could well be determined by an annual public hearing to establish for some midwestern base-zone market the appropriate Class I differential over manufacturing values. The general level of Class I prices so established could further be subject to a nationwide supply-demand adjuster which would automatically raise prices when supplies were short and lower them when oversupplies developed. Such an adjuster was worked out for data from 1961 to date.

GEOGRAPHIC PATTERN OF FLUID MILK PRICES: A COMPUTER ANALYSIS

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INTRODUCTION

The spatial equilibrium model for milk pricing is a tool for analyzing the geographic pattern of Class I prices in the Federal milk orders. It shows what Class I prices would result if milk from low-priced markets flowed freely to all markets where Class I prices were sufficiently high to cover hauling costs. As a background for the particular model presented herein, we briefly set forth the principal features of the present Class I price structure of the Federal milk orders. This is followed by a review of the main features of the various spatial models which have been applied to milk prices and a more detailed look at the present model. Prices obtained from the application of the present model to 1965 data are then compared with the actual Class I prices in the 73 Federal order markets. Also some possible adaptations and year-to-year use of the model are considered. Finally, an evaluation is provided of the features and limitations of the model.

Class I Prices in Federal Orders

In each Federal order market, the dealers are charged for the milk they bottle at the Class I price of the order under which they are regulated. The Class I price applies to all their fluid sales, even if the milk is not sold within the defined local market. Since nearly every market has some sales of packaged or bulk milk by dealers subject to some other order, all dealers have a direct interest in the intermarket alignment of Class I prices such that no one dealer will have a cheaper source of milk than another.

Any milk not used as Class I is processed into dairy products and is classified as Class II (Class III in a few orders). Since these products are nationally marketed, any milk used to produce them has only the same value as manufacturing grade milk. It follows that Class II prices in the various orders vary only slightly from the manufacturing grade prices. Producers are paid a blend price reflecting the volumes sold at the Class I and Class II prices.

In most orders, the Class I price is determined each month by a formula based on manufacturing values plus a stated differential designed to reflect marketing conditions, so as to achieve an adequate supply of milk. Since the supply does not need to be local, prospective supplies from other sources constitute a major consideration in establishing the level of the local Class I price. In the northeastern markets of the United States--those markets on the Washington-Boston axis--Class I prices are based on economic formulas including income and the Bureau of Labor Statistics wholesale price index rather than on manufacturing milk values. In all major markets, the Class I price formulas also include a supply-demand adjuster which raises prices when the regular supplies for a market fall below normal in relation to Class I sales and lowers prices when an oversupply is indicated.

Despite the considerable efforts made to achieve and maintain the desired Class I price alignment, misalignments do occur. They result from such causes

as imperfect knowledge of the myriad economic forces at work, drastic changes in the trade, new technologies of production, processing, and distribution, divergences between the two basic types of formulas for determining Class I prices, and variations in the supply-demand adjustments.

Objectives and Comparisons

The primary objective of applying spatial equilibrium models to milk prices is to develop a pattern of Class I prices in which no Class I price would be higher than the prices in any other market by more than the cost of transportation.

It is recognized that this primary objective can be achieved by a wide variety of models, featuring a correspondingly wide degree of relevance. Cassels' model in 1937, for instance, measured the extent to which Class I prices in major markets exceeded purely competitive models (5). 1/ Another approach was used by Bredo and Rojko in their model for prices and milksheds of northeastern markets (2). Their model took the existing density of milk production and of market demands as given and determined the optimum supply area (milkshed) for each market based on minimum hauling costs. Such a model was applied to nationwide data for 1965 by Richard F. Fallert of the U.S. Department of Agriculture. His results reflected the fact that all major markets were then more than adequately supplied; transportation costs from the milkshed peripheries to the centers of the 73 Federal order markets averaged only 14 cents per hundredweight, excluding the costs of assembly (unpublished ERS data). A serious limitation of such a model is that it provides no indication of what price level will be required to maintain the existing density of milk production.

Probably the best known models are those involving regression analysis, with actual prices as the dependent variable and distance from Eau Claire, Wis., as the independent variable (1, 3, 7, 9, 12). Eau Claire is the center of low-cost supplies of fluid grade milk. The rationale behind these models is that no price should exceed the Eau Claire price by more than hauling cost. A chief limitation of these models is that Eau Claire-plus-freight represents only an upper limit; in many milksheds an adequate supply can be developed at substantially lower prices. One other limitation is that the regressions indicate only potential price advantages, without relation to the quantities required or the available supplies.

The Freeman-Babb transportation model overcame some of these limitations (6). It explored the changes in prices which would have occurred if available supplies of milk had moved freely between markets to supply Class I needs without any change in the prices which prevailed in the supplying markets. This model used as a starting point the actual Class I prices which prevailed in each Federal order market in 1961. In 1965, more sophisticated models were used by Carley and Purcell to analyze price patterns in southern markets (4).

THIS MODEL

The current model is an adaptation of the Carley and Purcell model. It starts with the 1965 pattern of Class I prices, supplies of producer milk, and Class I requirements in each of the 73 Federal order markets. Using these data as inputs, the model determines what changes in Class I prices and marketings would have occurred on the assumption that milk flows freely from low-priced markets to any

1/ Underscored numbers in parentheses refer to Literature Cited, p. 18.

market where prices are high enough to cover the costs of the additional transportation. The analysis is designed to indicate what would have been the appropriate realignment of the Class I prices specified in the orders. The initial realignment reflects changes in utilization which would have resulted from redistribution of historical supplies as indicated by the model. In subsequent annual applications of the model, Class I prices could also reflect changes in supply and demand in the given market, whether these resulted from order prices or from premiums.

A free-flow model such as this one represents a marked departure from the historically local nature of fluid milk markets. Until World War II, most markets were quite local in character. Both Class I prices charged to dealers and the blend prices paid to producers differed substantially from market to market as a result of variations in classified price plans and related supply management policies. Even though improvements in transportation and refrigeration are making fluid milk markets less distinctly local, substantial price differences remain. Reasons for the differences range from the difficulty of developing new sales outlets or sources of supply to overt trade barriers of various types.

Changes have been taking place, however, that make the free-flow models more applicable. The forces of change include a long-standing Federal order policy directed toward Class I price differences no greater than hauling costs, a considerable and growing volume of Class I route sales of bottled milk by Federal order handlers into markets other than their primary market, and some procurement of raw milk from plants regulated under other orders.

These forces of change provide a substantial and growing demand for a technique which will provide a pattern of geographic alignment of Class I prices. The extent to which a model incorporates realistic assumptions largely determines the relevance of the solutions.

The model presented here is confined to a free-flow realignment of Class I prices in Federal order markets under a specified set of assumptions. This is not nearly as broad a model as was employed by Snodgrass and French (10) and by West and Brandow (13) in their studies of interregional competition. Those studies included both fluid grade and manufacturing grade milk and their solutions involved drastic changes in prices and in milk production. In contrast, the present Class I model results in comparatively minor changes in the prevailing pattern of prices and marketings.

The principal assumptions involved in this model, discussed in some detail in succeeding pages, are as follows:

1. The model starts from actual Class I prices, supplies, and proportion of producer milk used in Class I (including a 15-percent reserve) in each market in 1965.

2. As the model directs a free flow of milk from low-priced markets to high-priced markets, prices are raised in the shipping markets and lowered in the receiving markets until prices differ by no more than the cost of transportation.

3. The rate of change in prices per hundredweight, up or down, is 4 cents for each percentage point change in the percentage of producer milk indicated by the model as being used in Class I.

4. The starting supply and demand quantities for each market are those prevailing in October, the month when supplies are lowest in relation to Class I sales in most markets.

5. The starting point prices are the 1965 annual average Class I prices for each market, so the solution is also in terms of annual average prices.

6. The cost of transporting milk from one market to another is assumed to be 1.5 cents per 10 miles per hundredweight for highway mileages measured from the principal city in each market.

Features of the Computer Program

The computer routine employed in this model was Tramel's reactive programming technique, an iterative type of program (11). A principal feature of his program is that prices change as milk is shipped from low-priced to high-priced markets. His program incorporates price-quantity functions in each market as well as allowing for transportation costs between markets. In the present model, Tramel's technique was applied to 1965 data for the 73 Federal order markets to show how the 1965 Class I prices would have been altered if shipments of bulk or packaged milk had been made in response to any intermarket Class I price differences which exceeded hauling costs.

A basic feature of this application is a supply-demand adjuster. Like the supply-demand adjusters currently used in most orders, it raises Class I prices in each market when supplies are indicated by the model to be below normal and lowers prices when above normal supplies are indicated. The adjustment process is like that which would occur if dealers in a low-priced market expanded their sales routes into a high-priced market. Thus, if the model indicated shipments of Class I milk from Chicago to Philadelphia, the Chicago Class I price would rise in proportion to the increase in the percentage of the Chicago supply used in Class I sales to Philadelphia. In Philadelphia, on the other hand, the local Class I sales would be displaced to the extent of the inshipments from Chicago, the percentage of the local supply used in Class I would be reduced, and the Class I price would fall until the price differential equaled the hauling cost from Chicago to Philadelphia.

Quantity Data

In this model, producer receipts during October comprised the available supply of milk at each source. This is the month when receipts are lowest in relation to Class I sales in most markets. Any milk which is available in this month could, therefore, be considered as potential supply for Class I needs, at any time of the year, either in the local market or in other markets. The much larger quantities produced in any typical market during May could not be counted on for a permanent expansion of Class I sales and were, therefore, excluded from the model.

The demand schedule for milk used in this model was centered at Class I use in October. This included both in-area and out-of-area sales, since, for example, a Denver plant selling some milk in the Western Colorado markets needs to have the raw milk delivered at its Denver facility. However, deficit markets drew heavily on surplus markets for short-run needs during this month. To identify these temporary demands on the exporting markets, bulk out-of-market shipments in October were

compared with those during the previous May. It was assumed that any shipments in May represented regular demands for fluid use and that any increase in the shipments in October over the May shipments represented temporary demands. Market needs for Class I milk were determined by subtracting the temporary shipments from total Class I sales and adding a 15-percent reserve.

This reserve was provided to cover weekend and other variations in receipts and utilization during the month. A 15-percent reserve seems ample under current conditions. In a recent study of surplus disposal problems in midwestern markets, Whitted used a necessary reserve of only 10 percent (14).

Prices

This model deals with the Class I prices charged to dealers for milk used for fluid purposes rather than with the blend prices paid to producers. Thus, it focuses on interdealer competition for fluid sales. One reason for analyzing Class I price patterns is that four-fifths of the intermarket transfers are in the form of route sales of packaged milk, for which the applicable price is the Class I price in the originating market. 2/ A second reason is that there is also significant intermarket movement of bulk milk which is priced as Class I in the originating market. Third, dealers in a high-priced market are at a serious competitive disadvantage, especially on contract business and, to an increasing extent, on chainstore accounts. Finally, it is the Class I prices which are directly specified in the orders.

In computing the pricing functions, the model started with 1965 average Class I prices specified by the orders for milk delivered to city zone plants. The city zones are very large in most orders and encompass most of the regulated plants. They also encompass the majority of the sales territory in the other markets to which packaged or bulk milk might be expected to move. The 1965 annual average prices were used in preference to October prices to eliminate seasonal and other short-time differences. In some markets seasonal price changes are relied upon to encourage fall production, while in others a base rating plan or take-out and pay-back plan is used for this purpose. Using annual prices eliminates variations resulting from seasonal plans. Also, dealers seldom enter a market to exploit a purely seasonal price advantage, but might be expected to respond to differences persisting for a year or more.

Negotiated premiums were not included in the initial Class I price used to construct the model. While it is true that the present supplies reflect premiums, total supplies are not a limiting factor in major markets.

Transportation Function

A linear intermarket hauling function of 1.5 cents per hundredweight per 10 miles was used. For short hauls, this rate would be too low. However, in most cases there is a substantial distance from the center of one Federal order market to another, and the assumption of a constant rate is, therefore, reasonable.

The 1.5 cent rate is the one most commonly used for location adjustment in the orders to reflect the costs of hauling milk in large tank trucks and is within the

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2/ Route sales are sales of packaged milk on wholesale or retail routes, including sales to vendors or chainstore warehouses, but excluding sales to other regulated handlers. (For the volumes involved see (6), especially table 6.)

range cited in recent studies of milk transportation. This rate is somewhat below the rates commonly used in other recent studies of milk pricing, but some experience with regular long hauls indicates that it may be on the high side.

Supply-Demand Adjusters and Demand Functions 3/

The model provides a supply-demand adjustment function for each market, centered at the quantity of milk required for Class I use and at the 1965 Class I price. From this reference point, any indicated shipments to higher priced or deficit markets would raise the supplying market's Class I price by 4 cents per hundredweight for each percentage point of increase in the utilization percentage (percentage of producer milk used in Class I, including the out-of-market sales). Correspondingly, any displacement of Class I sales in a given market by milk from another market would reduce the local Class I price by 4 cents per 1-point drop in the percentage of the local supply of milk used for Class I.

The rate of supply-demand price adjustment is a critical element of the model. A low rate of adjustment in the Class I prices would involve considerable shifting of supplies from low- to high-priced markets before prices were aligned and would leave some residual price misalignments if supplies in the low-priced markets were limited. In the Freeman-Babb model (6), supply prices were fixed, and market prices did not change unless the local sales were completely supplanted by available milk from lower priced sources. Under these limitations, there was insufficient milk at the lower priced sources to achieve complete price alignment. A high rate of change in prices would minimize the milk transfers called for by the model and maximize price changes in the direction of complete alignment. The 4-cent adjustment used in this model is a somewhat higher rate than is used in most orders, though New York employs an adjustment of 1-percent change in price for each percentage point change in utilization.

In practice, marketing responses vary widely. In some markets, comparatively high Class I prices were maintained for years, sometimes despite substantial loss of sales by the local handlers and the producers regularly supplying them. In other markets, producers seek lower Class I prices as soon as some handler acquires or demonstrates that he can acquire cheaper alternative supplies.

The model also adjusts Class I consumption by a demand function in each market according to the indicated changes in the Class I prices at which milk was supplied to the market. The demand functions are highly inelastic; proportional changes in quantities used in Class I are only one-tenth of the percentage change in Class I prices. This reflects Johnson's analysis of many studies of the effect of price on milk consumption, indicating a trend towards less elasticity of demand as incomes rise, and showing a current figure of -0.1 (8).

Graphic Illustration of Model

Figure 1 illustrates the principal features of the model. In Chicago, the 1965 average Class I price (Po) was $4.02 per hundredweight and Class I needs during October 1965 were 242.0 million pounds, or 60.8 percent of the producer receipts of 398.0 million pounds. From this original point, $4.02 and 242 million pounds,

3/ See appendix for derivation of the supply-demand adjuster function and the demand function.

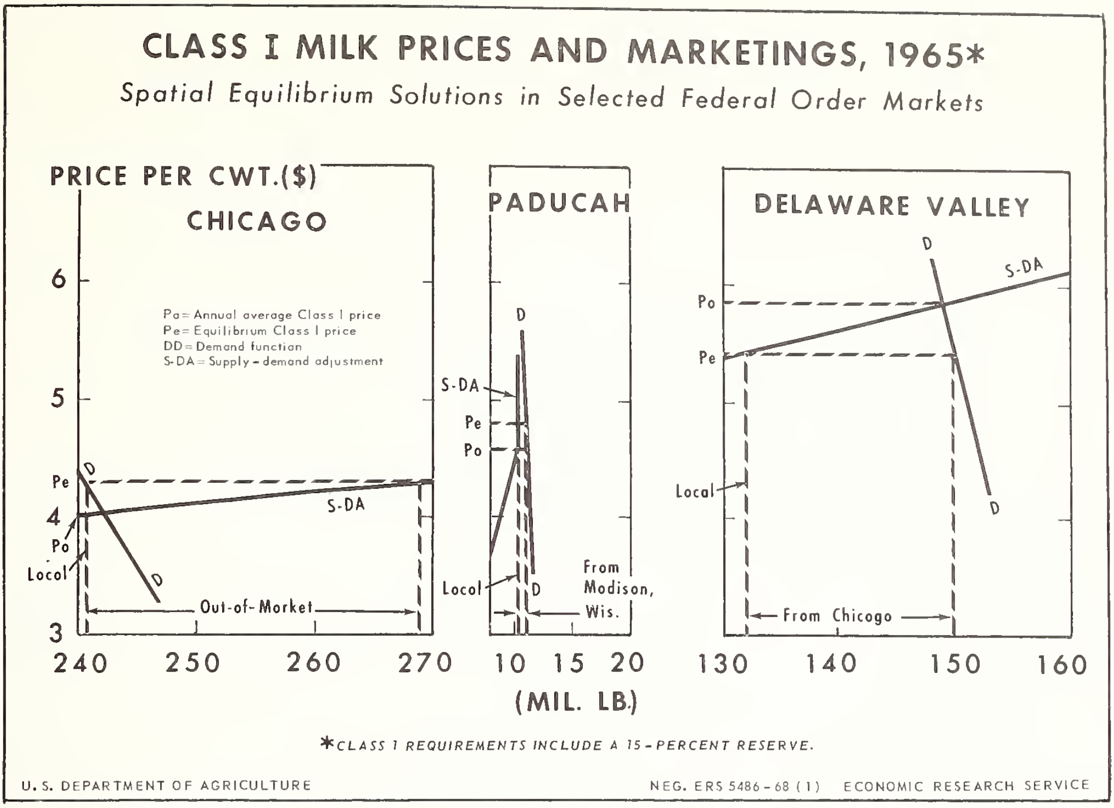

Figure 1

the linear demand function (DD) reflects a quantity change approximately one-tenth as great as any given price change. This demand function measures the response of those customers served by Chicago area handlers in October 1965; additional shipments to other markets are governed by demand functions in the receiving markets, by the supply-price relationships in each market, and by the intermarket hauling cost. The supply-demand adjuster (S-DA) slopes upward at the rate of 4 cents per 1-point rise in the percentage of milk utilized in Class I.

At the equilibrium solution, Chicago would have shipped 28.8 million pounds to various other markets. Total Class I use would have been raised thereby to 269.1 million pounds, which would have raised Class I utilization to 67.6 percent (up 6.8 points) and the Class I price (Pe) to $4.29 (up 27 cents). The increase in the Class I price would have reduced local consumption by 1.7 million pounds, or 0.7 percent. The Class II residual indicated by the model would have dropped to 128.9 million pounds, as compared with the 1965 figure of 156.0 million. In reality, of course, milk does not move; rather, the model shows what Class I prices would have prevailed if the indicated movements had occurred.

In the Delaware Valley (Philadelphia) market, the 1965 Class I price was $5.85 and Class I requirements 149.0 million pounds, or 95.7 percent of the local supply of 155.7 million pounds. The 1965 Class I price exceeded the original Chicago price by $1.83, as compared with a hauling cost of $1.11. At the equilibrium solution, the Philadelphia price would have dropped to $5.40, or $1.11 over the equilibrium Chicago price of $4.29. At this lower price, only 132.0 million pounds of the Class I market would have been supplied by the local trade; 18.2 million pounds would have been received from Chicago; in response to the lower price, Class I consumption would have risen by 1.2 million pounds to 150.2 million pounds; and 23.7 million pounds of the local supply would have been manufactured as Class II.

The model contains an assumption of a somewhat unrealistic supply response by the Philadelphia shippers and dealers. Under the model, Class I supplies, bulk or bottled, would have come into the market from Chicago, displacing local supplies and sales. This process would have lowered the Philadelphia utilization percentage and reduced prices until the new equilibrium was reached.

In practice, the local dealers in high-priced markets might well be expected to request a prompt price reduction in order to hold their markets. However, this is not a serious deficiency of the model. We note that if a steeper supply-demand adjuster were used in all high-priced, deficit markets, intermarket price alignment would be achieved by much smaller shipments from the low-priced surplus areas. There is complete price alignment under the present model. Clearly, complete alignment would also be achieved, at a somewhat lower level of shipments and prices, under any modification which would raise the rate of the supply-demand adjustment.

In the Paducah market, the October 1965 local supply of 10.3 million pounds was 0.7 million below the Class I needs (as defined in the model) of 11.0 million pounds, at the 1965 average Class I price of $4.61. The model provides a maximum supply for each producing area based on the actual quantity delivered by producers. The effect of such a maximum is to make the supply function vertical at this point, as shown in figure 1. 4/ This maximum limit on supply reflects uncertainty about the conditions under which additional milk could be attracted. Obtaining additional regular supplies from local shippers for the Paducah or any other market might involve encouraging a conversion from manufacturing grade milk to fluid grade or obtaining new shippers from a distance. Clearly, there is no assurance that the price change of 4 cents per percentage point change of Class I utilization will call forth additional supplies. Therefore, imposing a maximum availability appears more realistic than extending the supply-demand adjuster to larger quantities than those supplied in October 1965.

RESULTS OF MODEL

High-Priced Markets

The price changes resulting from application of the model to 1965 data are shown on the map in figure 2 (also see table 1). The enclosed, shaded areas include the high-priced markets into which the model would have directed shipments, thereby reducing Class I prices by the indicated amounts. There would have been substantial reductions in Class I prices in the six major markets in the northeastern United States. In these markets, cheaper milk from midwestern sources would have captured some local sales, reducing Class I prices and thereby slightly increasing Class I use. Local sources would have supplied 94 percent of the total Class I requirements and outside sources the remaining 6 percent. In October 1965, producers in the six markets supplied 1,541 thousand pounds of milk, of which 78 percent were needed for Class I and the 15-percent reserve. Under the model, only 73 percent of these local supplies would have been used for Class I and the average Class I price reduction would have been 18 cents, ranging from an 11-cent reduction for New York to a 45-cent reduction for the Delaware Valley (Philadelphia) market. The sources of the cheaper milk would have included Youngstown-Warren, Northwestern Indiana, Northeastern Ohio, Southern Michigan, and Chicago.

4/ If the sloped portion of the Paducah supply curve were extended to indicate a local supply-demand equilibrium, it would intersect the demand curve at a price of $4.85 and a quantity of 10.9 million pounds.

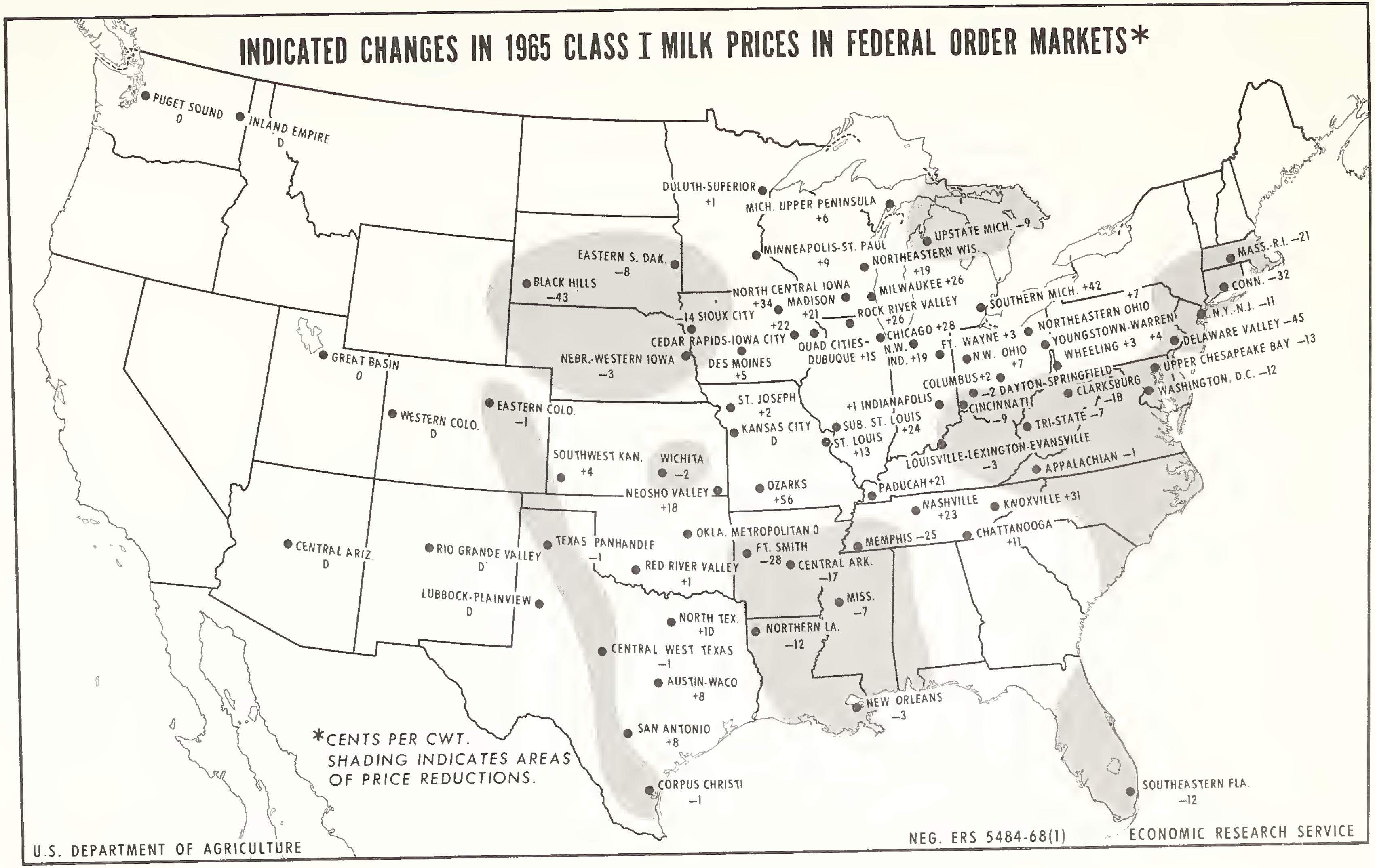
INDICATED CHANGES IN 1965 CLASS I MILK PRICES IN FEDERAL ORDER MARKETS*
PUGET SOUND 0
INLAND EMPIRE D
GREAT BASIN 0
WESTERN COLO. D
EASTERN COLO. –1
CENTRAL ARIZ. D
RIO GRANDE VALLEY D
LUBBOCK-PLAINVIEW D
TEXAS PANHANDLE –1
BLACK HILLS –43
EASTERN S. DAK. –8
NEBR.-WESTERN IOWA –3
SOUTHWEST KAN. +4
WICHITA –2
NEOSHO VALLEY +18
OKLA. METROPOLITAN 0
RED RIVER VALLEY +1
NORTH TEX. +10
CENTRAL WEST TEXAS –1
AUSTIN-WACO +8
SAN ANTONIO +8
CORPUS CHRISTI –1
DULUTH-SUPERIOR +1
MICH. UPPER PENINSULA +6
MINNEAPOLIS-ST. PAUL +9
UPSTATE MICH. –9
NORTHEASTERN WIS. +19
MILWAUKEE +26
NORTH CENTRAL IOWA +34
MADISON +21
ROCK RIVER VALLEY +26
–14 SIOUX CITY
+22 CEDAR RAPIDS-IOWA CITY
QUAD CITIES-DUBUQUE +15
DES MOINES +5
CHICAGO +28
N.W. IND. +19
ST. JOSEPH +2
KANSAS CITY D
+1 INDIANAPOLIS
SUB. ST. LOUIS +24
ST. LOUIS +13
OZARKS +56
FT. SMITH –28
CENTRAL ARK. –17
MISS. –7
NORTHERN LA. –12
NEW ORLEANS –3
MEMPHIS –25
PADUCAH +21
NASHVILLE +23
KNOXVILLE +31
CHATTANOOGA +11
APPALACHIAN –1
LOUISVILLE-LEXINGTON-EVANSVILLE –3
SOUTHERN MICH. +42
FT. WAYNE +3
N.W. OHIO +7
COLUMBUS +2
–2 DAYTON-SPRINGFIELD
CINCINNATI –9
TRI-STATE –7
CLARKSBURG –18
NORTHEASTERN OHIO +7
YOUNGSTOWN-WARREN +4
WHEELING +3
MASS.-R.I. –21
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Figure 2

The Clarksburg, Tri-State, Cincinnati, Dayton-Springfield, Louisville-Lexington-Evansville, and Southeastern Florida markets also would have suffered displacement of local milk by milk from outside sources and would have had small reductions in Class I prices. In Southeastern Florida, local supplies would have been below Class I needs, as computed in the model, so supplemental milk would have had to be obtained. However, the needed milk would have been obtained at lower prices; thus some of the local supplies would have been displaced from Class I and would have been disposed of in manufacturing outlets at Class II prices.

Another vulnerable territory would have included the Memphis, Central Arkansas, Fort Smith, Northern Louisiana, Mississippi, and New Orleans markets. Here, the high-priced local milk would have been partially displaced by milk from the Ozarks, St. Louis, Suburban St. Louis, Neosho Valley, Quad Cities (Iowa-Illinois), Madison, and Rock River Valley markets.

In a fourth area of high prices, comprising the Nebraska-Western Iowa (Omaha), Sioux City, Eastern South Dakota (Sioux Falls), and Black Hills (Rapid City, S. Dak.) markets, the model indicated Class I sales by handlers from Des Moines and Minneapolis-St. Paul.

In four markets the model would have reduced prices only 1 cent. Eastern Colorado (Denver) would have attracted milk from St. Joseph, Mo., the Texas Panhandle (Amarillo) from Southwest Kansas (Dodge City), Central West Texas (Abilene) from the Red River Valley, and Corpus Christi from North Texas (Dallas). Wichita would have received milk from St. Joseph, Mo., with a 2-cent price reduction.

In Lubbock-Plainview (Texas) and all six of the markets west of it, the model did not indicate any flow of milk or changes in prices.

Principal Shipping Markets

Chicago and Southern Michigan (Detroit) would have been by far the major shippers of milk under the terms of the model. As we have seen (fig. 1), Chicago would have shipped nearly 29 million pounds, 7 percent of its total supply, raising the Class I price by 28 cents. Detroit shipments would have been even larger, amounting to nearly 37 million pounds, or 11.2 percent of its total supply, and raising the Class I prices by 42 cents. These shipments would have filled shortages in Midwestern markets as far south as Paducah, but the major portion would have been attracted by high prices in the Northeastern markets--Connecticut, New York, Philadelphia, Baltimore, and Washington. In 1965, the Detroit Class I price averaged $4.15, only 13 cents over Chicago, as compared with a hauling cost of 40 cents. Thus, Detroit would have been a cheaper source than Chicago for Eastern markets.

Other markets from which significant quantities of milk would have been shipped under the model include Minneapolis, shipping to Black Hills (S. Dak.), Sioux City, Eastern South Dakota, and North Central Iowa; St. Louis and Ozarks (Springfield, Mo.), shipping to Memphis, Central Arkansas (Little Rock), and Northern Louisiana (Shreveport); Nashville, shipping to Southeastern Florida (Miami); and North Texas (Dallas), shipping to Austin-Waco, San Antonio, and Corpus Christi.

Other Results of Model

The increased prices generated by the model in the upper midwest would have reflected mainly the shipment of milk to the deficit or high-priced markets. In Texas,

the higher prices would have reflected shortages at Corpus Christi, San Antonio, and Austin-Waco. These deficiencies would have been filled, at the higher prices, from North Texas (Dallas).

In the Ozarks market, centered at Springfield in southwestern Missouri, the model would have raised Class I prices rather drastically, from the 1965 average of \$4.23 to \$4.79. While this territory still produces sizable quantities of manufacturing grade milk, it also ships fluid grade milk to the St. Louis, Kansas City, Oklahoma, Central Arkansas, and Texas markets. In the model, the comparatively small volumes of excess Grade A milk available in 1965 would have displaced some of the high-priced local supplies in Northern Louisiana (Shreveport), and the remainder would have been absorbed in Central Arkansas and Fort Smith, without supplying all the deficit in those markets. Under the terms of the model, the Arkansas and Oklahoma markets would have also drawn milk from the St. Louis and Neosho Valley (Joplin, Mo.) markets, leaving the Ozarks price above these more remote sources by the amount of hauling costs. In effect, the model showed that the Ozarks market could have sold all its available milk at substantially higher Class I prices, if milk from this and other sources could have freely entered southern markets.

In practice, such a drastic increase in Class I prices would, however, seriously affect the competitive position of handlers based at Springfield and might also result in a considerable increase in supplies, through conversion of manufacturing grade shippers to Grade A shippers and through expansion of output by present Grade A dairymen.

If St. Louis and Kansas City are to remain prime outlets for milk produced in the Ozark territory and Springfield is to be adequately supplied, it will be necessary for the Class I prices of Springfield to be lower than those at St. Louis or Kansas City by the hauling cost. It should be noted, however, that the prices indicated by the model for Central Arkansas and other markets south of the Ozarks would have appropriately reflected the higher, free-flow level of Ozarks prices.

ADAPTATIONS

The model can be applied to successive years and can be modified to reflect any changes which may occur in milk marketing to accommodate alternative rates of response to the supply-demand balance, or to incorporate month-to-month changes in receipts and sales for the entire system.

Adjusting General Level of Prices

The prices resulting from the model would have been higher than the 1965 prices in the upper midwestern markets from which shipments would have been drawn, and lower in the northeastern, midsouthern, and Black Hills-Omaha-Sioux City markets. In effect, the model would have maintained the same national level of Class I prices, but redistributed the local market price levels within a narrower range.

The appropriate level of prices in the upper midwestern dairy heartland is a broader problem than is dealt with by a model which is concentrated on intermarket alignment, given the present level of supplies in Federal order markets. In 1965, Detroit, Chicago, and Cleveland had much more milk than was needed for Class I and there would have been no need for the 30-cent increase indicated by the model

to achieve adequate supplies. However, it is also recognized that substantial premiums over order prices have prevailed for some years and bear some responsibility for the excess supplies.

One means of establishing a general level of Class I prices for use in the model would be to define a "base zone" to include the major upper midwestern markets. Alternatively, the market having the lowest price in the equilibrium solution (Northeastern Wisconsin) could be used as a base. The Class I price in the base zone or lowest priced market could be determined on the basis of public hearing proceedings at which an appropriate differential over manufacturing milk values and other related factors could be considered. Each of the market prices established by the model could then be adjusted to this base price by adding or subtracting the amount indicated by the model.

National Supply-Demand Adjustment

The computer model could readily be modified to include a supply-demand adjuster for the entire Federal order system of Class I prices. For example, an adjuster could be applied to the base market price each month, employing the percentage of receipts used in Class I during the second and third preceding months as compared with seasonally adjusted norms.

Such an adjuster would make it possible to raise Class I prices promptly when national supplies were below normal in relation to Class I use and lower prices when an oversupply was indicated. Even though the Federal orders set minimum prices, they should approximate the correct price as nearly as possible.

One possible form of adjuster is shown in figure 3. In the upper portion, the actual utilization percentage each month for all 73 markets is compared with a "normal" percentage. 5/ In this example, the adjuster was computed by the method specified in the New York-New Jersey order. The seasonal index was developed from a 36-month moving average and the annual average normal utilization was set at 61 percent, the level which prevailed in 1961-62. The amount of adjustment, at 4 cents per percentage point change in utilization, is shown in the bottom portion of the figure.

The decline in U.S. milk production which became evident in the latter half of 1965 was clearly reflected in the Federal order data as actual utilization began to exceed normal utilization. The amount added to Class I prices by the proposed supply-demand adjustment would have risen steadily after April 1965 to a peak of 21.2 cents in July 1966. The adjustment would have approximated 15 cents per hundredweight in January 1967.

YEAR-TO-YEAR CHANGES

The model calls for increases in Class I prices in some markets and decreases in others. If these were effectuated, producers would tend to respond by increasing or decreasing the quantity of milk supplied. These changes would be reflected in annual reruns of the model.

5/ Utilization percentages are also available for "comparable" orders, those for which there were no significant changes in marketing area. However, this leaves out Milwaukee, Rock River, Northwestern Indiana, and Chicago. Since most, but not all, of the milk formerly regulated under the Chicago order continues to be regulated under these other orders, it appears that the all-market utilization provides more consistent coverage than the "comparable" series.

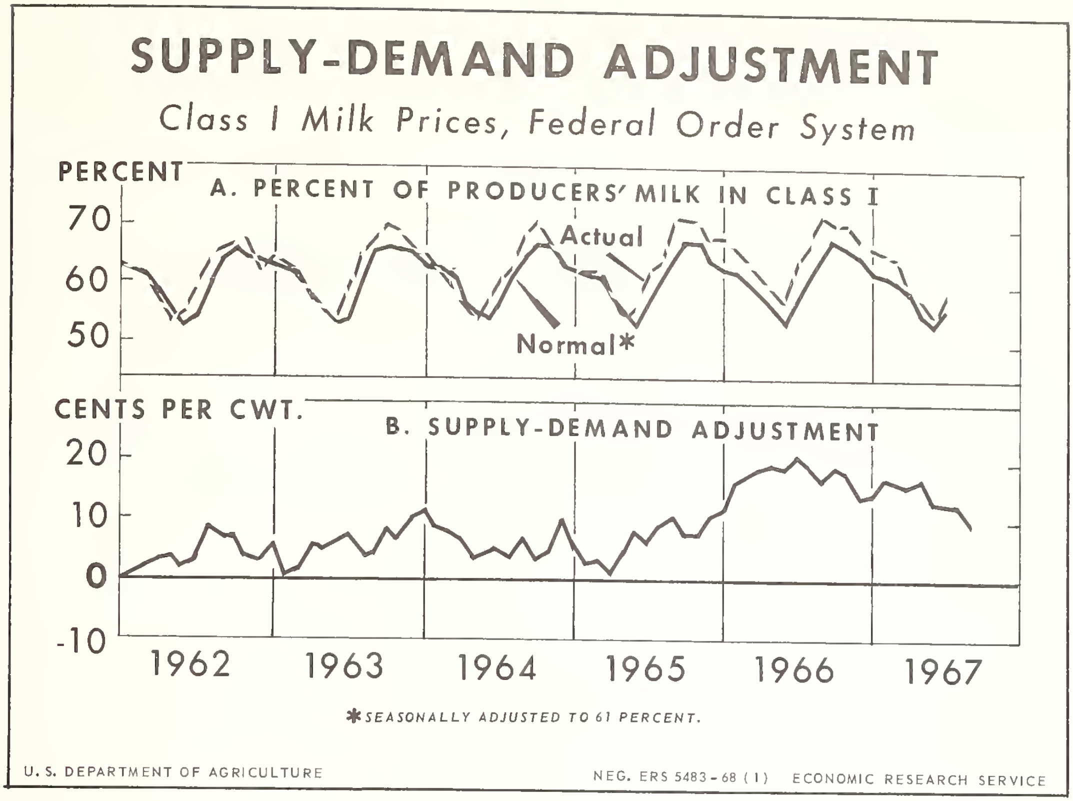

Figure 3

Application of Model to 1966 Data

The model was applied to 1966 data. This was a particularly interesting test of the model because the Chicago order was terminated early in 1966. Since milk from most of the plants was sold in Milwaukee, Northeastern Wisconsin, or other nearby markets, most of the milk remained under Federal order regulation. The few Chicago plants which sold their milk only in the terminated order area did not remain under Federal order regulation. It was appropriate, therefore, that their supplies and sales were not included in the model. The milk from these plants would not be subject to regulation until a significant amount was sold to other Federal order markets.

Other changes in area from 1965 to 1966 involved the consolidation of Southwest Kansas into the Wichita market and of St. Joseph into the Kansas City market. A new order was issued for the Tampa Bay area.

The manufacturing milk price, used as the basic formula price in most orders, was 60 cents per hundredweight higher in 1966 than in 1965. In the six northeastern markets, the economic index price was only 20 to 30 cents above 1965 levels. In most markets, the 1966 suspensions of seasonal declines and other special actions added another 6 to 14 cents to the 1965 Class I prices.

Normal Utilization Percentages

In applying the model to 1966 data, the October 1965 percentage of producer milk used in Class I was retained as a normal in most markets. As previously

pointed out, a recent historical base has the virtue of making minimum changes in the geographic price structure. However, it also involves accepting some rather atypical utilization percentages as normal.

Milwaukee receipts jumped from 77 million pounds in October 1965 to 292 million in October 1966 and Class I needs from 77 million pounds to 195 million, as a result of the former Chicago plants coming under regulation. The Class I utilization percentage dropped from 100 percent to 67 percent. These changes are so drastic that Milwaukee should clearly be provided with a new normal utilization percentage.

Figure 4 shows, on the right, the solutions obtained for Milwaukee, first by using 1965 utilization as the normal, and second by using 1966 utilization as the normal. The 1965 utilization function and demand schedules resulting from application of the model to 1965 data for Milwaukee appear in the left portion of the figure, reflecting the smaller quantities then involved. In the 1966 application, the lower supply-demand function (S'-DA) is based on the 1965 actual utilization of 99.96 percent as normal, while the upper one (S-DA) is adjusted to the 1966 actual utilization of 66.72 percent as normal. In each case, the greatly reduced upward slopes of these curves from 1965 to 1966 reflect the much greater supplies of producer milk in 1966 which lower the "b" values in these straight-line functions. The use of 1966 as normal shifts the function upward by the 1965 to 1966 33.24 percentage point change in utilization multiplied by 4 cents, or $1.33. The 1966 demand curve is also shifted far to the right of the 1965 demand function. The new "a" value in the demand function is based on the 1966 Class I price, and the "b" value is a function of the 1966 price and the 1966 Class I use at that price, inclusive of a 15-percent reserve.

These changes drastically affect the entire problem. With the 1965 utilization percentage used as normal, the supply-demand function (S'-DA) indicated that an adequate supply for local Class I requirements could be obtained at a Class I price of slightly under $3.50. With such an unrealistically low supply-demand function, the model designated Milwaukee as the primary shipping market. Shipments would have amounted to 85.6 million pounds before Class I prices would have come into equilibrium, at a Milwaukee value of $4.59 (P'e). With a supply-demand function computed using 1966 utilization as normal, local Class I needs of 194.7 million pounds would have been met at a price of $4.74. The equilibrium solution would have involved shipments of only 3.6 million pounds and an equilibrium Class I price of $4.78 (Pe).

It appeared that the Northeastern Wisconsin market had also been affected by Chicago milk to an extent that would call for use of 1966 data as a normal. The new market, Tampa Bay, was also provided with a new normal since there were no prior data. The expanded Wichita and Kansas City markets were so large in proportion to the absorbed markets that no adjustment was needed in the 1965 normals for these markets.

In any actual application of the model, for any markets undergoing substantial changes there should be a careful appraisal of need for change in the normal utilization percentage.

Results of the 1966 Application

This observer was surprised by the extent to which the 1966 solution differed from the 1965 results of the model, even after providing a revised normal for Milwaukee and Northeastern Wisconsin (see table 2).

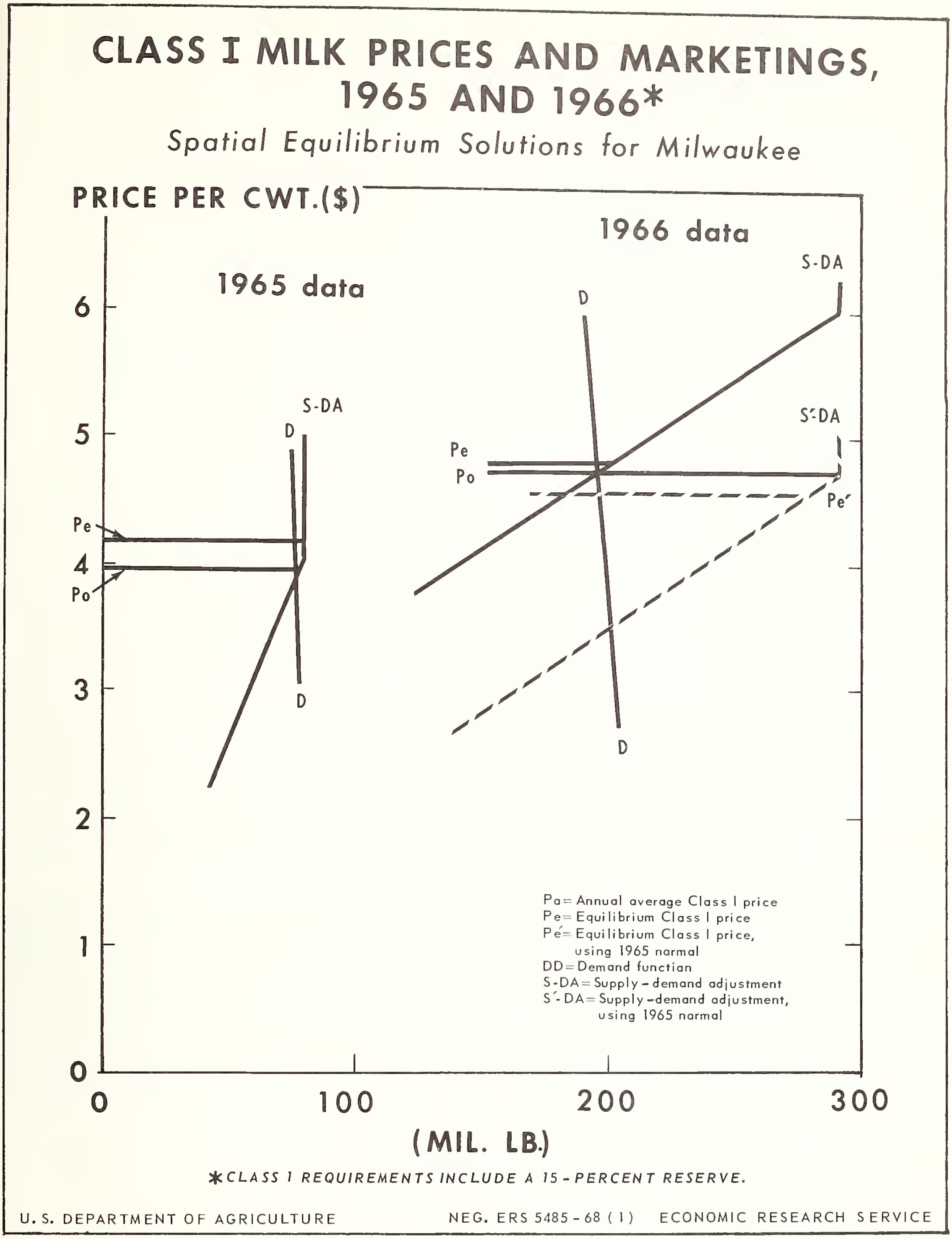
CLASS I MILK PRICES AND MARKETINGS, 1965 AND 1966*
Spatial Equilibrium Solutions for Milwaukee
PRICE PER CWT.($)
1966 data
1965 data
S-DA
D
S'-DA
Pe
Po
Pe'
0
1
2
3
4
5
6
100
200
300
(MIL. LB.)
Pa= Annual average Class I price
Pe= Equilibrium Class I price
Pe'= Equilibrium Class I price, using 1965 normal
DD= Demand function
S-DA= Supply - demand adjustment
S'-DA= Supply-demand adjustment, using 1965 normal
*CLASS 1 REQUIREMENTS INCLUDE A 15-PERCENT RESERVE.
U. S. DEPARTMENT OF AGRICULTURE
NEG. ERS 5485-68 (1)
ECONOMIC RESEARCH SERVICE

Figure 4

In the upper midwest, Minneapolis-St. Paul would have been the key market. Class I requirements, inclusive of the 15-percent reserve used in the model, were down slightly from the 73.2 million pounds in October 1965 to 72.8 million in October 1966. Receipts from producers increased drastically, from 78.0 million pounds in October 1965 to 112.4 million in October 1966. The Class I utilization percentage dropped from the 1965 level of 94 percent to 65 percent in 1966. Thus, as illustrated in figure 4 for Milwaukee, the 1966 supply-demand function (based on 1965 as normal) had a lower slope than the 1965 function (.036 and .051, respectively). In Minneapolis-St. Paul, the larger supplies appear to have resulted from changes in local market organization rather than from the termination of the Chicago order. Therefore, any case which might be made for modifying the use of the 1965 utilization as a normal would have to rest on a more careful appraisal of the changes in marketing conditions.

With so much more milk available in 1966, at such low prices, Minneapolis-St. Paul would have shipped 20.1 million pounds in the 1966 solutions, as compared with only 1.8 million in the 1965 solutions. The shipments, and their effect on prices, would have extended south to Kansas City, Oklahoma City, Wichita, and Dallas and west to Des Moines, Sioux City, Omaha, and Denver.

Elsewhere in the upper midwest, Southern Michigan would have exerted much less influence in 1966 than in 1965. On the other hand, more substantial shipments were indicated from smaller markets, including Knoxville, Suburban St. Louis, Neosho Valley, St. Louis, Ozarks, and Indianapolis.

We have already noted that 1966 Class I prices advanced much less from 1965 levels in the six northeastern markets than did the prices in the other markets because the economic indicators rose less than did prices of manufacturing milk. As might be expected, much smaller shipments would have been required to equalize prices at midwestern-plus-hauling costs. In fact, New York would have become the largest supplier in the entire 71-market system, shipping 23.5 million pounds to Connecticut and Massachusetts-Rhode Island. Only Philadelphia would have drawn on lower priced milk from outside the region--from Detroit, Fort Wayne, and Wheeling.

There were several other notable differences between the 1965 and 1966 solutions generated by the model. They illustrate the changes in annual pricing patterns which would have resulted from applications of the model, as follows:

1. In all but two of the markets in Minnesota, Iowa, the Dakotas, and Nebraska, actual 1966 utilization percentages were much below the normal (1965) levels. As a result, the equilibrium Class I prices for 1966 would have been substantially below actual prices. In Black Hills, the 1966 supply-demand function was so much lower that a small quantity would have been shipped to Eastern Colorado (Denver).

2. In Eastern Colorado, actual 1966 utilization was somewhat lower than in 1965, but the principal price-reducing influence would have been the availability of excess milk at lower prices in the Minneapolis, Eastern South Dakota, and Black Hills markets.

3. In Western Colorado, the increased supplies forthcoming in 1966 substantially reduced the supply-demand function and caused a small price-equalizing shipment to the Great Basin (Salt Lake City) market.

4. In the Texas Panhandle (Amarillo) market, 1966 supplies were increased enough over the 1965 supplies to reduce the local supply price to a point where demands would have been filled by the local supply.

Actual vs. Model in 1966

One limitation of the 1966 application should be pointed out. The prices which actually prevailed in 1966 differed from those which would have been generated by the 1965 model. It follows that the changes in supplies and in Class I sales were also different from those which would have occurred if prices generated by the 1965 model had prevailed in 1966. The 1966 model does, however, demonstrate the considerable price changes which would be produced by such a model in response to changes in local supplies and demands.

In each market, the supply-demand function would be shifted each year at the rate of 4 cents per percentage point change in the utilization percentage. In most markets, however, Class I prices would change by smaller amounts. If local supplies increased, outshipments to other markets would tend to reduce the decline in prices. If local supplies were reduced, inshipments from other markets would tend to check the rise in prices.

EVALUATION

The background of Federal order pricing and the features and applications of the model have been set forth in the preceding sections. An evaluation of the model will be provided by listing and commenting briefly on the principal points of relevance and the principal limitations of the model.

Advantages of the Model

1. Price alignment.--The model does provide a price pattern within which there is complete geographic alignment at the principal milk marketing center of each area.

2. Uniformity.--In the model, the price adjusting functions are the same in all markets. Also, in successive years, prices in each market would respond to local changes in supply and demand, subject, of course, to any intermarket movements which might be indicated.

3. Adjustment of general level of prices.--The general level of Class I prices in the entire system could readily be made subject to an overall supply-demand adjuster. Such an adjuster would raise prices in response to the generally tighter supply situation, such as that which began to develop in mid-1965.

4. Single pricing standard.--The model involves a single pricing standard throughout the Federal order system. The supply-demand balance in each market and transfer costs between markets would determine Class I prices. This structure would rest upon the annual determination of an appropriate general level of prices, preferably in a midwestern base-zone market, perhaps subject to an automatic supply-demand adjuster. This would avoid the disparities created by the use of manufacturing prices in some markets and general economic indexes in others.

Limitations of the Model

1. Substantial changes in Class I price.--The chief limitation of the model is that it substitutes a national set of prices for the historically local prices which

reflect the influence of producers' organizations and other local institutions. Even though the Federal order authorities have made alignment a major consideration, local and regional differences occur and persist. The local differences in present prices have arisen from the substantive variations in the two major methods of setting Class I prices, from variations in the supply-demand adjusters, and from institutional forces which maintain a closer balance between supply and demand in some markets than in others.

2. Supply and demand functions.--The principal conceptual shortcoming of the model is that a particular set of supply and demand functions is used. In this case, we based them on the producer receipts, Class I quantities, and Class I prices which prevailed in 1965. The considerable price changes in some markets which are indicated by the model could be expected to bring about varying readjustments in local supplies and Class I use. In practice, some of the supply responses would require several years to be completed, since expansion or contraction of milk production on any given farm is a lengthy process. Intermarket shifts of supplies also involve considerable time in most instances. Meanwhile, the model would continue to reflect actual supplies and Class I use rather than those which would represent the ultimate equilibrium points.

3. Lack of market pressures.--Despite the substantial intermarket price differences prevailing in 1965 and 1966, as disclosed by application of the model, there have not been corresponding changes in marketings. 6/ In the absence of such pressures as the actual receipt of bulk milk or distribution of bottled milk from an outside market, producers in local markets feel that no Class I price reduction is warranted. The opposite occurs in the low-priced shipping markets; any increase in prices without the indicated potential of outshipments would tend to add to surpluses. However, instead of raising prices in these markets, it is suggested that the whole level of prices generated by the model be readjusted to the lowest priced market, at a level determined to be appropriate for such markets.

4. Normal utilization percentages.--The model accepts the 1965 percentage of producer milk in Class I as normal. This has the virtue of minimizing the resulting changes in Class I prices and of using a recent base as normal, but may reflect some peculiar short-run circumstances in particular markets. For example, it accepts a very low utilization percentage as "normal" in most of the larger markets.

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APPENDIX

Supply-Demand Adjuster Functions

From the available data we can construct a linear function, of the form c=a+bx, for each market which centers at the 1965 price-quantity point, as follows:

Where c = Equilibrium Class I cost,
65 Cl. I = 1965 average Class I price,
65 S = October 1965 Class I sales plus a 15-percent reserve,
65 R = October 1965 receipts of milk from producers, and
E S = Equilibrium Class I sales,

we have:

$$c = 65\text{ Cl. I} + .04 \left[\left(\frac{E\ S}{65\ R} \times 100\right) - \left(\frac{65\ S}{65\ R} \times 100\right)\right]$$

reflecting the fact that the equilibrium price produced by the model will differ from the 1965 price by 4 cents per point that the equilibrium utilization percent differs from the 1965 (normal) utilization, and with E S as the unknown.

Solving for "a," which is the value of c in this linear function at the point where E S is zero, we have:

$$a = 65\text{ Cl. I} - .04 \left(\frac{65\ S}{65\ R} \times 100\right).$$

If this portion of the original equation represents "a," our linear equation, of the form c = a + b E S, where E S is the unknown, becomes:

$$c = \left[65\text{ Cl. I} - .04 \left(\frac{65\ S}{65\ R} \times 100\right)\right] + \frac{4.00}{65\ R}\ E\ S.$$

In deficit markets, those in which Class I requirements (inclusive of the 15-percent reserve) exceeded receipts from producers and the 1965 utilization percentage was over 100, the formula for computing the "a" value was modified by using 100 as the 1965 utilization, to reflect the fact that the 1965 supplies were brought forth at a blend based on the 1965 Class I price.

Demand Functions

The demand functions, which are also linear in the form p=a+bx, centered at the 1965 Class I use, inclusive of a 15-percent reserve, and the 1965 Class I price, can be worked out as follows:

Where p = Equilibrium Class I price,
65 Cl. I = 1965 average Class I price,
65 S = October 1965 Class I sales plus a 15-percent reserve,
65 R = October 1965 receipts of milk from producers, and
E S = Equilibrium Class I sales,

we have:

$$p = 65\ Cl.\ I\ -\ 10\ \left(65\ Cl.\ I\right)\ \left(\frac{E\ S}{65\ S}\right)$$

reflecting a change in the equilibrium price equal to 10 times any change in the ratio of equilibrium Class I sales to 1965 sales.

Solving for "a," at that value of p in this linear function at which there is no change in sales or prices from 1965 levels, we have:

$$p = 65\ Cl.\ I = a - 10\ (65\ Cl.\ I)\ \left(\frac{1}{1}\right) \quad \text{and}$$

$$a = 11\ (65\ Cl.\ I).$$

Then, inserting this solution for "a" and solving the remainder for "b" with equilibrium sales as the unknown, we have:

$$p = 11\ (65\ Cl.\ I)\ -\ 10\ \left(\frac{65\ Cl.\ I}{65\ S}\right)\ E\ S.$$

Table 1.--Spatial equilibrium in Federal order milk markets with 1965 data

Region and State	Class I price: 1965	Class I price: Equilibrium	Class I requirements (October): 1965	Class I requirements (October): Equilibrium	Equilibrium supplies: Local	Equilibrium supplies: Other markets: Receipts from	Equilibrium supplies: Other markets: Shipments to	Producer receipts, October 1965
	Dol.	Dol.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.
NEW ENGLAND								
Massachusetts-Rhode Island	5.96	5.75	198,797	199,510	185,664	13,846	---	257,403
Connecticut	5.97	5.65	86,351	86,820	79,259	7,561	---	89,167
MIDDLE ATLANTIC								
New York-New Jersey	5.64	5.53	621,647	622,875	598,821	24,054	---	881,654
Delaware Valley	5.85	5.40	149,010	150,155	131,981	18,173	---	155,701
SOUTH ATLANTIC								
Upper Chesapeake Bay	5.43	5.30	62,222	62,369	59,730	2,639	---	72,562
Washington, D.C.	5.43	5.31	77,070	77,245	74,365	2,879	---	84,587
Wheeling	4.88	4.91	13,563	13,555	13,555	---	126	15,936
Clarksburg	5.21	5.03	6,656	6,678	6,339	339	---	7,130
Tri-State	4.99	4.92	33,994	34,040	33,453	587	---	34,115
Appalachian	5.19	5.18	26,421	26,424	24,059	2,365	---	24,153
Southeastern Florida	6.39	6.27	44,140	44,225	41,969	2,256	---	43,361
EAST NORTH CENTRAL								
Eastern Group:								
Upstate Michigan	4.57	4.46	4,100	4,110	3,957	153	---	4,862
Southern Michigan	4.15	4.57	234,507	232,128	232,128	---	36,876	330,632
Northwestern Ohio	4.57	4.64	45,003	44,939	37,178	7,761	8,707	46,172
Northeastern Ohio	4.74	4.81	118,126	117,963	106,748	11,215	13,846	137,346
Columbus	4.72	4.74	43,479	43,458	43,458	---	275	45,271
Dayton-Springfield	4.72	4.70	34,237	34,254	33,914	340	---	38,994
Cincinnati	4.82	4.73	50,188	50,285	48,793	1,492	---	59,028
Youngstown-Warren	4.85	4.89	16,743	16,730	16,730	---	167	17,825
EAST NORTH CENTRAL								
Western Group:								
Michigan Upper Peninsula	4.00	4.06	8,607	8,594	8,594	---	153	8,799
Northeastern Wisconsin	3.80	3.99	28,030	27,893	27,893	---	1,764	34,670
Milwaukee	3.91	4.17	76,590	76,089	74,325	1,764	2,291	76,616
Rock River Valley	3.95	4.21	9,739	9,674	9,674	---	70	9,744
Chicago	4.02	4.30	242,015	240,337	238,046	2,291	31,017	398,008
Northwestern Indiana	4.24	4.43	30,680	30,546	30,546	---	1,640	32,186
Fort Wayne	4.49	4.52	18,950	18,937	18,197	740	927	22,095
Louisville-Lexington-Evansville	4.76	4.73	69,912	69,962	69,325	637	---	77,987
Indianapolis	4.56	4.57	71,927	71,906	71,433	473	637	74,394
Suburban St. Louis	4.38	4.62	23,446	23,318	23,318	---	1,239	24,556
Madison	3.91	4.12	11,584	11,522	11,522	---	794	15,460
WEST NORTH CENTRAL								
Northern Group:								
Duluth-Superior	4.16	4.17	8,670	8,668	8,668	---	---	11,390
Minneapolis-St. Paul	4.04	4.13	73,150	72,986	72,986	---	1,784	77,992
Eastern South Dakota	4.56	4.48	12,376	12,397	12,117	281	---	13,291
Black Hills	5.41	4.98	3,513	3,541	3,103	438	---	3,880
North Central Iowa	4.08	4.42	24,604	24,402	22,764	1,638	---	22,764
Cedar Rapids-Iowa City	4.10	4.32	13,325	13,253	13,253	---	654	13,907
Quad Cities-Dubuque	4.12	4.27	16,414	16,356	16,356	---	739	18,952
Des Moines	4.38	4.43	25,412	25,384	25,384	---	361	29,202
Sioux City	4.66	4.52	4,746	4,761	4,548	213	---	5,619
Nebraska-Western Iowa	4.66	4.63	38,050	38,077	37,716	361	---	41,251
WEST NORTH CENTRAL								
Southern Group:								
St. Joseph	4.49	4.51	10,718	10,712	10,712	---	79	12,216
St. Louis	4.48	4.61	65,149	64,956	64,956	---	2,339	70,157
Ozarks	4.23	4.79	21,255	20,975	20,975	---	1,337	22,312

--Continued

Table 1.--Spatial equilibrium in Federal order milk markets with 1965 data--Continued

Region and State	Class I price: 1965	Class I price: Equilibrium	Class I requirements (October): 1965	Class I requirements (October): Equilibrium	Equilibrium supplies: Local	Equilibrium supplies: Other markets: Receipts from	Equilibrium supplies: Other markets: Shipments to	Producer receipts, October 1965
	Dol.	Dol.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.
Kansas City	4.59	4.59	53,853	53,854	53,850	4	---	60,014
Neosho Valley	4.62	4.80	8,055	8,023	8,023	---	462	9,331
Wichita	4.86	4.84	21,849	21,856	21,794	62	---	24,329
Southwest Kansas	4.91	4.95	4,284	4,281	4,281	---	49	4,714
EAST SOUTH CENTRAL								
Paducah	4.61	4.82	10,958	10,907	10,288	619	---	10,288
Nashville	4.65	4.88	33,893	33,723	33,723	---	1,695	35,418
Memphis	5.31	5.06	25,981	26,105	23,697	2,408	---	25,325
Knoxville	4.69	5.00	17,836	17,719	17,719	---	883	18,602
Chattanooga	4.98	5.09	17,518	17,480	17,480	---	561	20,057
Mississippi	5.44	5.37	31,026	31,066	30,329	738	---	35,019
WEST SOUTH CENTRAL								
Northern Group:								
Central Arkansas	5.30	5.13	19,811	19,876	18,329	1,547	---	19,195
Fort Smith	5.32	5.04	4,461	4,485	3,952	532	---	4,250
Oklahoma Metropolitan	5.02	5.02	42,394	42,393	42,393	---	---	48,515
Red River Valley	5.22	5.23	15,233	15,229	15,229	---	69	17,417
Texas Panhandle	5.33	5.32	14,308	14,310	14,261	49	---	15,916
Lubbock-Plainview	5.31	5.31	7,218	7,219	7,219	---	---	7,335
WEST SOUTH CENTRAL								
Southern Group:								
Northern Louisiana	5.53	5.41	17,413	17,452	16,847	605	---	18,218
New Orleans	5.66	5.63	32,456	32,473	32,074	399	---	39,338
North Texas	5.20	5.30	76,354	76,213	76,213	---	2,195	85,096
Central West Texas	5.46	5.45	15,783	15,787	15,718	69	---	15,805
Austin-Waco	5.50	5.58	12,810	12,792	12,074	718	---	12,074
San Antonio	5.63	5.71	22,022	21,992	21,631	361	---	21,631
Corpus Christi	5.89	5.88	15,727	15,729	14,613	1,116	---	14,645
MOUNTAIN								
Eastern Colorado	5.36	5.35	48,661	48,666	48,653	13	---	54,178
Great Basin	5.25	5.25	27,047	27,046	27,046	---	---	32,355
Western Colorado	5.31	5.31	3,474	3,474	3,474	---	---	3,648
Central Arizona	5.54	5.54	40,416	40,419	40,419	---	---	44,333
Rio Grande Valley	5.38	5.38	24,991	24,993	24,993	---	---	25,581
PACIFIC								
Puget Sound	4.91	4.91	56,578	56,581	56,581	---	---	109,530
Inland Empire	5.12	5.12	12,948	12,947	12,947	---	---	14,915
All markets			3,510,474	3,508,096	3,394,362	113,736	113,736	4,310,419

Table 2.--Spatial equilibrium in Federal order milk markets with 1966 data

Region and State	Class I price		Class I requirements (October)		Equilibrium supplies			Producer receipts, October 1966
						Other markets		
	1966	Equilibrium	1966	Equilibrium	Local	Receipts from	Shipments to	
	Dol.	Dol.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.
NEW ENGLAND								
Massachusetts-Rhode Island	6.48	6.30	194,429	194,970	181,543	13,427	---	249,582
Connecticut	6.48	6.16	88,955	89,398	79,278	10,120	---	89,179
MIDDLE ATLANTIC								
New York-New Jersey	6.06	5.98	559,958	560,716	560,716	---	23,547	853,265
Delaware Valley	6.16	6.01	150,404	150,760	140,392	10,368	---	152,301
SOUTH ATLANTIC								
Upper Chesapeake Bay	5.85	5.86	61,873	61,858	61,858	---	1,113	73,096
Washington, D.C.	5.86	5.85	78,274	78,292	78,292	---	---	86,355
Wheeling	5.39	5.51	11,459	11,434	11,434	---	422	13,452
Clarksburg	5.75	5.56	6,554	6,576	6,576	---	---	7,434
Tri-State	5.60	5.37	34,855	35,000	35,000	---	263	37,584
Appalachian	5.94	5.67	27,813	27,938	24,449	3,489	---	26,198
Tampa Bay	6.85	6.43	30,296	30,481	27,109	3,372	---	30,430
Southeastern Florida	6.93	6.76	44,426	44,532	42,160	2,372	---	43,867
EAST NORTH CENTRAL								
Eastern Group:								
Upstate Michigan	5.32	4.82	3,564	3,597	3,597	---	067	5,091
Southern Michigan	4.84	5.16	233,502	231,969	231,969	---	8,893	304,929
Northwestern Ohio	5.29	5.25	42,594	42,627	39,023	3,604	4,212	44,720
Northeastern Ohio	5.48	5.41	115,937	116,076	111,796	4,279	---	132,339
Columbus	5.43	5.37	41,499	41,545	39,964	1,581	---	42,217
Dayton-Springfield	5.32	5.29	35,344	35,367	32,817	2,550	---	37,855
Cincinnati	5.42	5.25	50,675	50,839	50,839	---	---	63,189
Youngstown-Warren	5.58	5.48	18,214	18,246	17,551	695	---	19,175
EAST NORTH CENTRAL								
Western Group:								
Michigan Upper Peninsula	4.72	4.52	8,942	8,980	8,980	---	251	9,929
Northeastern Wisconsin	4.51	4.60	28,581	28,524	28,524	---	840	36,823
Milwaukee	4.74	4.78	194,659	194,513	193,674	840	3,583	291,776
Rock River Valley	4.65	4.80	9,952	9,920	9,491	429	---	9,491
Northwestern Indiana	4.82	5.03	28,808	28,680	28,680	---	748	29,428
Fort Wayne	5.15	5.13	19,441	19,447	18,469	978	1,475	23,329
Louisville-Lexington-Evansville	5.38	5.28	69,882	70,009	69,199	810	---	79,422
Indianapolis	5.23	5.12	73,166	73,324	73,324	---	3,360	81,608
Suburban St. Louis	5.15	5.16	24,809	24,806	24,806	---	4,277	30,441
Madison	4.61	4.71	11,606	11,581	11,581	---	1,170	16,616
WEST NORTH CENTRAL								
Northern Group:								
Duluth-Superior	4.83	4.51	8,317	8,371	8,371	---	---	12,289
Minneapolis-St. Paul	4.81	4.38	72,757	73,403	73,403	---	20,142	112,413
Eastern South Dakota	5.17	4.68	12,092	12,206	12,206	---	625	15,848
Black Hills	6.04	5.04	3,066	3,117	3,117	---	122	4,920
North Central Iowa	4.77	4.61	23,361	23,441	23,441	---	948	25,445
Cedar Rapids-Iowa City	4.82	4.70	13,864	13,900	13,900	---	1,683	16,816
Quad Cities-Dubuque	4.83	4.81	16,844	16,850	15,837	1,013	---	18,345
Des Moines	4.97	4.77	24,903	25,004	21,481	3,523	---	26,130
Sioux City	5.30	4.79	5,037	5,086	4,880	206	---	6,805
Nebraska-Western Iowa	5.30	4.93	40,564	40,847	38,031	2,816	---	45,685
WEST NORTH CENTRAL								
Southern Group:								
St. Louis	5.23	5.13	62,698	62,820	62,150	670	4,867	74,215
Ozarks	4.98	5.23	23,390	23,271	23,271	---	4,009	27,280
Kansas City	5.27	5.08	70,296	70,545	70,001	544	---	82,166

--Continued

Table 2.--Spatial equilibrium in Federal order milk markets with 1966 data--Continued

Region and State	Class I price: 1966	Class I price: Equilibrium	Class I requirements (October): 1966	Class I requirements (October): Equilibrium	Equilibrium supplies: Local	Equilibrium supplies: Other markets: Receipts from	Equilibrium supplies: Other markets: Shipments to	Producer receipts, October 1966
	Dol.	Dol.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.	Thou. lb.
Neosho Valley	5.25	5.29	5,568	5,564	5,564	---	1,044	7,575
Wichita	5.52	5.35	29,203	29,295	27,949	1,347	---	32,729
EAST SOUTH CENTRAL								
Paducah	5.37	5.35	10,649	10,653	9,946	707	---	9,999
Nashville	5.40	5.38	31,810	31,821	31,821	---	4,303	37,907
Memphis	5.97	5.57	25,724	25,896	22,826	3,070	---	25,251
Knoxville	5.32	5.49	17,485	17,429	17,429	---	4,668	22,096
Chattanooga	5.64	5.59	15,564	15,578	14,658	920	930	18,149
Mississippi	6.14	5.89	30,207	30,331	28,861	1,470	---	35,116
WEST SOUTH CENTRAL								
Northern Group:								
Central Arkansas	5.98	5.57	21,557	21,704	18,614	3,091	---	20,749
Fort Smith	5.91	5.49	3,587	3,612	3,121	491	---	3,478
Oklahoma Metropolitan	5.68	5.59	42,468	42,537	41,017	1,520	---	48,149
Red River Valley	5.92	5.79	16,177	16,212	16,212	---	394	19,654
Texas Panhandle	6.01	5.69	13,144	13,213	13,213	---	---	16,135
Lubbock-Plainview	6.17	5.86	6,639	6,673	6,673	---	---	7,357
WEST SOUTH CENTRAL								
Southern Group:								
Northern Louisiana	6.16	5.86	17,156	17,239	16,460	778	---	18,736
New Orleans	6.41	6.16	32,221	32,346	28,438	3,908	---	37,246
North Texas	6.08	5.82	74,073	74,387	66,137	8,250	4,313	84,518
Central West Texas	6.32	6.02	15,280	15,353	14,324	1,029	---	15,577
Austin-Waco	6.38	6.11	16,646	16,715	14,586	2,129	---	15,607
San Antonio	6.49	6.23	21,742	21,830	20,855	975	---	22,261
Corpus Christi	6.59	6.41	19,626	19,680	17,874	1,806	---	18,707
MOUNTAIN								
Eastern Colorado	5.98	5.65	48,098	48,365	45,272	3,092	---	55,425
Great Basin	5.95	5.87	25,926	25,962	25,911	051	---	31,742
Western Colorado	5.93	5.43	3,272	3,300	3,300	---	051	4,040
Central Arizona	6.15	6.15	39,305	39,305	39,305	---	---	43,019
Rio Grande Valley	6.10	6.10	25,739	25,739	25,739	---	---	26,357
PACIFIC								
Puget Sound	5.55	5.72	60,128	59,939	59,939	---	---	106,816
Inland Empire	5.71	5.44	12,708	12,768	12,768	---	---	15,951
All markets			3,359,362	3,364,312	3,261,992	102,320	102,320	4,189,824

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